

REMARKS

In the latest Office Action, claims 1, 2, 3, 10, 17, 22, 24, and 25 were rejected under 35 U.S.C. 103(a) as being unpatentable over Manson (U.S. Patent No. 6,248,689) in view of Campbell et al. (U.S. Patent No. 5,451,558). Manson teaches an oxidation catalyst and a particulate filter positioned in the exhaust passage of a diesel engine where the catalyst comprises metals selected from Group IB, Group VIII and Group 5B metals, preferably copper, iron and vanadium. The Examiner asserts that Manson teaches a platinum catalyst on a zirconia-silica support having strong acid sites, but fails to teach that the conversion of NO to NO<sub>2</sub> occurs at a temperature between 175° to 250°C as claimed. The Examiner further asserts that Campbell teaches an oxidation catalyst which converts a portion of NO to NO<sub>2</sub> at a temperature between 93°C to 185°C, concluding that this limitation recites the operating range of “virtually all oxidizing catalysts” and thus would have been obvious to one skilled in the art.

Applicants first wish to point out that Manson does not teach the specific combination of a platinum catalyst on a zirconia-silica support as claimed. Rather, Manson teaches that the preferred catalyst materials are copper, iron and vanadium, which may **optionally** include one or more platinum group metals. Nor does Manson teach or suggest the use of a catalytic support **having strong acid sites** as claimed. While the Examiner refers to col. 5, lines 17-67 of Manson as teaching a support material having strong acid sites, this disclosure refers to the process for making the **catalyst**, i.e., mixing the metals as a weakly acidic solution. And, while Manson lists silica-zirconia as a possible support, he does not teach or suggest that such a support has strong acid sites as claimed, nor does he teach or suggest forming such a support by impregnating silica gel with a zirconium citrate ammonium complex as recited in previously presented claim 29.

Nor is there is any disclosure in Manson of incorporating oxides and/or acids into the support as taught and claimed in the present invention (see the specification at page 4, lines 23-34, and page 5, lines 2-5, and claims 8, 9, 15 and 16 as amended). Rather, Manson teaches that the only requirement for the support is that it have flow-through capability and sufficiently convoluted passageways. See col. 5, lines 55-60.

With regard to the claimed temperature range for conversion of NO to NO<sub>2</sub>, applicants wish to point out that not all catalysts exhibit the same activity at the same temperature ranges, contrary to the Examiner's assertion. As taught in the background portion of the present invention, catalysts such as platinum are active at temperatures lower than 300°C, but generally exhibit low activity at temperatures below 250°C. Applicants have discovered that by utilizing a platinum catalyst in combination with a zirconia-silica support having strong acid sites, the activity of the catalyst is increased at temperatures below 250°C, i.e., between 175 to 250°C, and more preferably, between 200 to 250°C. None of the prior art references recognize the advantage of using a platinum catalyst in combination with a zirconia-silica support having strong acid sites to achieve conversion at the claimed temperature ranges. Nor do any of the references teach or suggest a method which results in the conversion of about 60 to 96% of NO to NO<sub>2</sub> as recited in claim 28.

With regard to Campbell et al., applicants wish to reiterate that the catalyst of Campbell et al. comprises a catalyst/absorber, i.e., the catalyst includes highly **basic** adsorption components. This teaching is in direct contrast to that of the present invention, which desires a highly acidic catalyst having a pKa of between about 5 to 13 (see claim 27). Nor do Campbell et al. teach a zirconia-silica support as claimed. While Campbell et al. teach a support which may comprise a combination of zirconia and silica, combining zirconia and silica alone would not produce the claimed zirconia-silica support, which is formed by impregnating silica with a zirconium citrate ammonium

complex to form a support having highly acidic properties.

Accordingly, one skilled in the art would not look to the catalyst materials of Campbell et al. to achieve the NO<sub>x</sub> oxidation activity shown by the present invention. Nor would one skilled in the art assume from the teachings of Manson or Campbell that "all oxidizing catalysts" could achieve the conversion of NO to NO<sub>2</sub> at the claimed operating temperatures.

Claims 4 and 18 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Manson in view of Campbell et al. and further in view of Murachi et al. (U.S. Patent No. 5,746,989). The Examiner has concluded that it would have been obvious to one skilled in the art to use a second catalyst positioned downstream from the particulate filter as taught by Murachi in the "modified Manson system." However, as pointed out above, none of the references teach or suggest the claimed combination of a platinum catalyst on a zirconia-silica support having strong acid sites, nor do any of the references recognize the increased activity/NO conversion which results from such a combination. Claims 4 and 18 are clearly patentable over the cited references.

Claims 5 and 19 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Manson in view of Campbell et al. and further in view of Andreasson et al. The Examiner has cited Andreasson for teaching an SCR positioned downstream of the particulate filter. Again, applicants submit that there is no motivation to modify Manson as none of the cited references teach or suggest an oxidation catalyst comprising platinum on a zirconia-silica support having strong acid sites as claimed.

Claims 6 and 20 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Manson in view of Campbell et al. and further in view of Khair et al. The Examiner has cited Khair et al. for teaching that it is conventional in the art to use a NO<sub>x</sub> trap positioned downstream from an oxidation catalyst. Applicants submit that claims 6 and 20 are patentable for the same reasons discussed above with regard to

claims 4, 5, 18 and 19.

Claims 7 and 11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Manson in view of Campbell et al. and further in view of design choice. The Examiner acknowledges that neither Manson nor Campbell teach the claimed amounts of platinum, zirconia, and silica, but reasons that the claimed ranges would have been an obvious matter of design choice. Applicants disagree. As neither Manson nor Campbell et al. teach or suggest using the specific combination of platinum on a zirconia-silica support having strong acid sites for the purpose of converting NO to NO<sub>2</sub>, it is not believed that the amounts of the components of the oxidation catalyst would have been obvious. Claims 7 and 11 are clearly patentable over the cited references.

Claims 8, 9, 15 and 16 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Manson et al. in view of Campbell et al. and further in view of Yoshimoto et al. (JP 02-056250). The Examiner has cited Yoshimoto et al. for teaching a catalyst carrier which may include oxides and a heteropolyacid. However, there is no teaching or suggestion in Yoshimoto et al. or any of the other references of adding oxides or heteropolyacids to a zirconia-silica support as taught and claimed in the present invention. Rather, Yoshimoto teaches a carrier comprising a TiO<sub>x</sub> metal oxide in combination with WO<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>, etc., where the carrier is **optionally** treated with a heteropolyacid. Nor do Yoshimoto et al. nor any of the other references recognize that the activity of a **platinum** catalyst is increased by the addition of an oxide or heteropolyacid to a **zirconia-silica** support material. There is clearly no motivation to use the acidic components of Yoshimoto et al. in the catalyst support of Manson.

Claims 12-14 and 23 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Manson in view of Campbell et al. and further in view of Cooper et al. (U.S. 4,902,487) and design choice. While the Examiner acknowledges that Manson does not teach the claimed pretreatment of the catalyst, he asserts that it would have

Serial No. 09/683,642  
Docket FRD 0189 PA (200-1206)

been obvious to do so in view of Cooper et al., who teach the use of NO<sub>2</sub> to combust particulate on a filter using a catalyst such as platinum, palladium, etc. As previously pointed out, Cooper does not teach or suggest that the treatment is carried out at a temperature between about 500 to 650°C as recited in claim 14. While the Examiner asserts that the temperature range is an obvious matter of design choice, applicants disagree. Cooper specifically teaches that efficient oxidation occurs at temperatures less than 400°C (see the Examples and claim 3). Accordingly, there is no motivation for one skilled in the art to use a higher temperature range as claimed. And, as none of the references teach or suggest the combination of a platinum catalyst on a zirconia-silica support having strong acid sites, there is clearly no motivation to combine the teachings of the references.

Claim 26 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Twigg et al. (U.S. 6,294,141) in view of Deeba et al. The Examiner maintains that it would have been obvious to use the oxidation catalyst of Deeba et al. as the first oxidation catalyst in Twigg et al. First, neither Deeba et al. nor Twigg et al. teach or suggest the claimed oxidation catalyst, i.e., platinum on a zirconia-silica support having strong acid sites. Second, the Examiner has provided no substantive reasoning as to why one skilled in the art would be motivated to make such a substitution. Twigg et al. specifically teaches that the first catalyst should be supported on a **metal** monolith, not a ceramic support as claimed. Claim 26 is clearly patentable over the cited references.

Finally, applicants wish to point out that the Examiner did not indicate the status of previously presented claims 27, 28 and 29 on the Office Action Summary page, nor did he reject the claims in the body of the Office Action. The Examiner is respectfully requested to indicate the status of these claims in his next communication.

Serial No. 09/683,642  
Docket FRD 0189 PA (200-1206)

For all of the above reasons, applicants submit that claims 1-20 and 22-29, as amended, are patentable over the cited references. Early notification of allowable subject matter is respectfully requested.

Respectfully submitted,

DINSMORE & SHOHL, LLP

By Susan M. Luna  
Susan M. Luna  
Registration No. 38,769

One Dayton Centre  
One South Main Street, Suite 500  
Dayton, Ohio 45402-2023  
Telephone: (937) 223-2050  
Facsimile: (937) 223-0724